

## CLAIMS

We claim:

- 1 1. A composition comprising a modified nucleotide including a molecular and/or atomic tag,  
2 where the nucleotide alters base incorporation fidelity in a nucleotide polymerizing agent relative  
3 to a base incorporation fidelity of the agent in the absence of the modified nucleotide.
- 1 2. The composition of claim 1, wherein the modified nucleotide comprises a  $\beta$  and/or  $\gamma$   
2 phosphate modified nucleotide.
- 1 3. The composition of claim 1, wherein the modified nucleotide comprises a  $\beta$  phosphate  
2 modified nucleotide.
- 1 4. The composition of claim 1, wherein the modified nucleotide comprises a  $\gamma$  phosphate  
2 modified nucleotide.
- 1 5. The composition of claim 4, wherein the tag comprises a molecule.
- 1 6. The composition of claim 5, wherein the tag is ANS.
- 1 7. A method comprising the step of adding a modified nucleotide including a molecular  
2 and/or atomic tag, where the nucleotide alters base incorporation fidelity of a nucleotide  
3 polymerizing agent relative to a base incorporation fidelity of the agent in the absence of the  
4 modified nucleotide, to a nucleotide polymerization medium comprising a nucleotide polymerizing  
5 agent.
- 1 8. The method of claim 7, wherein the modified nucleotide comprises a  $\beta$  and/or  $\gamma$  phosphate  
2 modified nucleotide.
- 1 9. The method of claim 7, wherein the modified nucleotide comprises a  $\beta$  phosphate modified  
2 nucleotide.
- 1 10. The method of claim 7, wherein the modified nucleotide comprises a  $\gamma$  phosphate modified

nucleotide.

11. The method of claim 10, wherein the tag comprises a molecule.

12. The method of claim 11, wherein the tag is ANS.

13. A method comprising the step of adding a modified nucleotide including a molecular and/or atomic tag, where the nucleotide alters base incorporation fidelity of a nucleotide polymerizing agent relative to a base incorporation fidelity of the agent in the absence of the modified nucleotide, to an assay for extending a nucleotide sequence, and the assay is selected from the group consisting of genotyping for *in vitro* reproductive methods (human and other organisms); single nucleotide polymorphism (SNP) detection; DNA sequencing; RNA sequencing; single nucleotide extension assays; amplified DNA product assays; rolling circle product assays; PCR product assays; allele-specific primer extension assays; single-molecule arrays (DNA, RNA, protein) assays; and drug toxicity evaluation assays.

14. A method for making blunt-ended fragments comprising the steps of amplifying a DNA fragment in the presence of a nucleotide including a molecular and/or atomic tag on a  $\gamma$  phosphate group and/or a base moiety, where the tag alters fidelity of base incorporation and decreases or eliminates non-templated addition of a base to the 3' end of the DNA fragment being amplified.

15. A kit for performing a nucleotide polymerizing reaction comprising polymerizing reagents and at least one modified nucleotide including an atomic and/or molecular tag, where the modified nucleotide alters extension fidelity.

16. A method of inhibiting or preventing pyrophosphorolysis during synthesis of a nucleic acid molecule, said method comprising

(a) combining a primer with a nucleic acid template under conditions sufficient to form a hybridized product; and

(b) incubating the hybridized product with a polymerase in the presence or absence of an enzyme selected from the group consisting of a pentosyltransferase, a phosphotransferase with alcohol group as acceptor, a nucleotidyltransferase, and a carboxy-lyase, under conditions sufficient to

8 form a second nucleic acid molecule complementary to all or a portion of the nucleic acid  
9 template,  
10 where a tagged nucleotide comprises an atomic and/or molecular tag or moiety attached to  
11 and/or associated with a  $\beta$  and/or  $\gamma$ -phosphate and/or a base moiety of the nucleotide is added at  
12 either or both steps to inhibit or prevent pyrophosphorolysis during synthesis of a nucleic acid  
13 molecule.

1 17. A composition comprising a nucleotide including a molecular and/or atomic tag on a  
2 phosphate group adapted to alter the fidelity of viral replication.

1 18. The composition of claim 17, wherein the virus is HIV.

1 19. A method for increasing the fidelity of replication comprising administering an  
2 therapeutically effective amount of a nucleotide including a molecular and/or atomic tag on a  $\gamma$   
3 phosphate group to an animal including a human, where the nucleotide is designed to increase base  
4 incorporation fidelity during replication.

1 20. The method of claim 19, wherein the replication is caused by an HIV virus.